CHAPTER 9

WILDLIFE CONTROL STRATEGIES AND TECHNIQUES AT AIRPORTS

This Fokker F-28 struck a red-tailed hawk on final approach to a major California airport, 1996. (Photo by T. C. Hall, USDA)

9.1. INTRODUCTION

No airport or aircraft type is immune from the hazards of wildlife strikes. Many species of birds and mammals have been involved in damaging strikes (Chapter 2). A flock of starlings suddenly rising from the ground, a lone kestrel hovering in search of prey, a pair of Canada geese taking flight after grazing in the infield, or a deer bounding across a runway all may result in significant aircraft damage or in extreme cases, a crash and loss of human lives. In addition to strikes, wildlife that are roosting, nesting or burrowing on airports can cause structural damage to buildings, pavement, equipment and aircraft, as well as nuisance and health problems for workers.

As discussed in Chapters 5 and 6 in the conduct of Wildlife Hazard Assessments and development of Wildlife Hazard Management Plans, the first step in solving any wildlife damage problem is to answer the following questions:

1. What are the wildlife doing which makes controlling their numbers or damage necessary? The answer to this question will, to a large extent, determine the control methods used.

2. Which species of wildlife are causing the problem? Different species require different management techniques.

3. What is the legal status at the federal, state and local levels of the problem wildlife? All wildlife are not afforded equal legal protection by all levels of government.

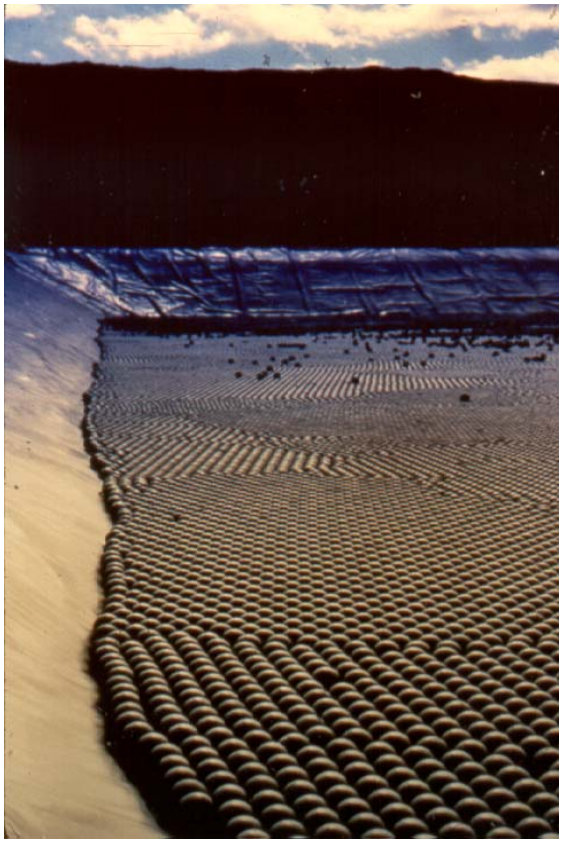
4. What are the daily and seasonal movement patterns of the wildlife among feeding, loafing, and roosting/nesting areas? Try to identify the times of day and seasons of year, as well as locations on airport, where the wildlife pose the most critical threat to aviation safety and where they are most vulnerable to management actions.

5. What effective and legal management methods are available? In wildlife hazard management, effective and legal are not necessarily synonymous.

6. How selective are these control methods? The objective is to control only the target wildlife, not every species in the area.

7. How much will it cost to apply the selected control methods? The cost of control may dictate which methods are practical, given the seriousness of the threat caused by the species.

8. What are public attitudes toward the problem wildlife species and the hazards that these species pose? Public opinion also may influence the type of management actions taken.

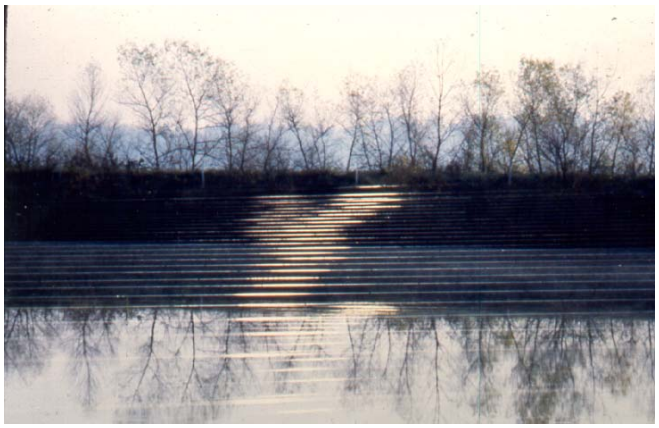


Floating plastic balls can be used to cover ponds and prevent birds from using the sites. (Photo courtesy Wildlife Materials, Inc.)

This chapter presents the overall approach that should be taken to manage wildlife hazards at airports. Once the overall approach is established, the chapter outlines the strengths and weaknesses of

various wildlife control methods recommended for use at airports, as well as certain methods that should not be used.

This chapter is not the final word on this subject. Wildlife damage control is a dynamic field, and new products and technologies are continuously being introduced. In addition, changes in the legal status of control techniques, chemical registrations and wildlife species occur at the federal and state level. Thus, this chapter should be viewed as a starting source for information on wildlife control techniques.



Overhead wires, spaced at 10-foot intervals, reduced waterfowl use of this sewage pond near an airport in the eastern U.S. (Photo by L. Terry, USDA)

It is recommended that this chapter be used in conjunction with the two-volume manual "**Prevention and Control of Wildlife Damage**" published in 1994 by Cooperative Extension, University of Nebraska at Lincoln (see full citation at end of this chapter). This manual, written by various experts in the field of wildlife damage control, provides detailed information on the techniques, equipment, chemical registrations, species-specific management recommendations and sources of supply for the various control strategies presented in this chapter. This manual is also available online in a periodically updated version at**: ianrwww.unl.edu/wildlife/solutions/handbook/.**

9.2. WILDLIFE CONTROL STRATEGIES

Four basic control strategies are available to solve wildlife problems at airports:

a. Flight schedule modification;

b. Habitat modification and exclusion;

c. Repellent and harassment techniques;

d. Wildlife removal.

All 4 control strategies should be integrated into the Wildlife Hazard Management Plan as appropriate.

9.2.a. Flight Schedule Modification

Although not generally practical for regularly scheduled commercial traffic on larger airports, there may be various situations when flight schedules of some aircraft can be adjusted to minimize the chance of a strike with a wildlife species that has a predictable pattern of movement. For example, pilots could be advised not to depart during a 30-minute period at sunrise or sunset during winter when large flocks of blackbirds cross an airport going to and from an off-airport roosting site. In situations such as at Midway Atoll where albatrosses and other seabirds are abundant during parts of the year, scheduling nighttime arrivals and departures, when birds are not flying, may be the only means of avoiding strikes. Finally, air traffic controllers on occasion may need to temporarily close a runway with unusually high bird activity or a large mammal (e.g., deer) incursion until wildlife control personnel can disperse the animals.

9.2.b. Habitat Modification and Exclusion

Habitat modification means changing the environment to make it less attractive or inaccessible to the problem wildlife. All wildlife need food, cover and water to survive. Any action that reduces, eliminates or excludes one or more of these elements will result in a proportional reduction in the wildlife population at the airport.

Initially, management actions to reduce food, cover, and water on an airport may be expensive. However, when costs are amortized over several years, these actions may be the least expensive approach to reduce wildlife populations on the airport. Once a habitat modification is done correctly, it is generally not necessary to go back and do it again. Also, these control methods are generally well accepted by the public and minimize the need to harass or kill wildlife on the airport.

9.2.b.i. Food

Some of the more common urban food sources for birds on and near airports include handouts from people in taxi stands and parks, grain elevators, sewage treatment plants and improperly stored food waste around restaurants and catering services. Rural food sources attractive to birds include sanitary landfills, feedlots, certain agricultural crops (especially cereal grains and sunflower), and spilled grain along road and rail rights-of-way.

Artificial feeding of waterfowl promotes unnaturally high bird concentrations. This can adversely effect aircraft safety. Feeding wildlife should be prohibited at airports and discouraged in areas near airports. (Photo by E. C. Cleary, FAA)

Airport operators should be aware of these food attractants for birds that exist

on and in close proximity to the airport. On the airport, operators should require bird-proof storage of food waste, prohibit bird feeding, and promote good sanitation and litter control programs. Agricultural crops attractive to birds, such as cereal grains and sunflower, should be prohibited on airport lands leased for farming within the separation criteria identified in AC 150/5200-33 (see Chapter 5 and Appendix C). For nearby off-airport areas, airport operators should work closely with local governmental entities and landowners to discourage land-use practices and activities that provide food sources for problem bird species.

Trees and other landscaping plants selected for the street side of airports should not produce fruits or seeds attractive to birds. On airside areas, the large expanses of grass and forbs can sometimes provide ideal habitat for rodent and insect populations that attract raptors, gulls, other bird species, and mammalian predators such as coyotes. In addition, grasses allowed to produce seed heads can provide a desirable food source for doves, blackbirds and other species. The management of airside vegetation to minimize rodents, insects and seeds may be complex, requiring insecticide, herbicide and rodenticide applications, changes in vegetation cover, and adjustments in mowing schedules (e.g., mowing at night to minimize bird feeding on insects exposed by the mowing). Such management plans will need to be developed in conjunction with professional wildlife biologists and horticulturists knowledgeable with the local wildlife populations, vegetation and growing conditions (see below).

9.2.b.ii. Cover

All wildlife need cover for loafing, roosting, escape, and reproduction. Pigeons, house sparrows, and European starlings use building ledges, abandoned buildings, open girders and bridge work, and dense vegetation for cover. Blackbirds use marsh vegetation such as cattails for nesting and roosting. Many bird problems can be solved by eliminating availability of such areas either through removal or by exclusion.

Giant Canada geese, left undisturbed, will establish territories on urban lakes and ponds. In just a few years a pair of geese can easily increase to a flock of 100 or more. (Photo by E. C. Cleary, FAA)

Care should be taken when selecting and spacing plants for airport landscaping, not only to avoid production of fruits and seeds desired by birds as discussed above, but also to avoid the creation of areas of dense cover for roosting and nesting. Bird roosts that do form in trees on airports can generally be eliminated by thinning the canopy of trees and perhaps selectively removing trees to increase their spacing.

The management of airport airside vegetation to minimize bird activity is a controversial subject in North America. The general recommendation, based on studies in England in the 1960s and 1970s, has been to maintain a monoculture of grass at a height of 6-10 inches (Transport Canada) or 7-14 inches (U.S. Air Force). Tall grass, by interfering with visibility and ground movements, is thought to discourage many species of birds from loafing and feeding. However, the limited studies conducted in North America have not provided a consensus of opinion on the utility of tall-grass management for airports. For example, Canada geese do not appear to be discouraged by tall grass. In addition, maintenance of tall grass may result in increased rodent populations, a food source for raptors. Finally, maintenance of uniform stands of tall grass is difficult on many airports because of varying soil conditions. Arid regions in the western United States cannot maintain tall grass without irrigation.

Regardless of the grass height on the rest of the airport, the grass within the runway and taxiway safety areas should be maintained at a height of 3-4 inches. This will allow airport personnel and Airport Certification Safety Inspectors to visually inspect these areas for ruts, humps, depressions or other surface irregularities.

Until more research is completed, no general guidelines on grass height or vegetation type for airside areas of airports will be made. Airport operators should consult with professional wildlife biologists and horticulturists to develop a vegetation type and mowing schedule that is appropriate for the growing conditions and wildlife at the location. The main principles to follow are to use a vegetation cover and mowing regime that do not result in a build-up of rodent numbers or the production of seeds, forage or insects desired by birds.

Finally, dense stands of trees and undergrowth on airport property can provide excellent cover for deer, coyotes, geese, raptors, roosting blackbirds, rodents, and other wildlife. In general, these habitats should be cleared or at least sufficiently thinned to eliminate the desired cover and to allow easy visual and physical access by wildlife control personnel. All unnecessary posts, fences and other structures that can be used as perches by raptors and other birds should be removed from airside areas. Piles of construction debris and discarded equipment, unmowed fence rows, and other unmanaged areas often provide excellent cover for commensal rodents (rats and house mice). Such areas should be eliminated from airports.

All areas of standing water on the airport operating area should be drained to discourage bird use. (Photo courtesy USAF)

9.2.b.iii. Water

Water acts as a magnet for birds; therefore, all standing water on airports should be eliminated to the greatest extent possible. Depressions in paved and vegetated areas and disturbed areas at construction sites that accumulate standing water after rain should be filled or modified to allow rapid drainage. This is particularly important at coastal airports where fresh water is highly attractive to birds for drinking and bathing. Retention ponds, open drainage ditches, outdoor fountains and other wetland sites should not be established on or adjacent to airports.

9.2.b.iv. Exclusion Techniques

If food, water, or cover can not be eliminated by habitat modification, then actions can sometimes be taken to exclude the wildlife from the desired resource. Exclusion involves the use of physical barriers to deny wildlife access to a particular area. As with habitat modification, exclusion techniques, such as installing a covered drainage ditch as opposed to an open ditch, can initially be costly. However, exclusion provides a permanent solution that is not only environmentally friendly, but when amortized over many years, may actually be the least expensive solution.

9.2.b.iv.a. Exclusion of Birds

Access to rafter and girded areas in hangars, warehouses, and under bridges can be

Birds can be prevented from roosting in hangars, warehouses, and under bridges by screening the rafters (left, photo by E. C. Cleary, FAA). Netting can also be installed over airport ponds to exclude birds (right, photo courtesy Wildlife Materials, Inc.).

eliminated with netting. Curtains made of heavy-duty plastic sheeting, cut into 12-inch strips, and hung in warehouse or hangar doorways, can discourage birds from entering these openings. Porcupine wire can be installed on ledges, roof peaks, rafters, signs, posts, and other roosting and perching areas, to keep birds from using them. Changing the angle of building ledges to 45 degrees or more will deter birds from perching.

Gull and waterfowl use of retention ponds and drainage ditches can be reduced with over-head wire systems. A system of wires spaced 10 feet apart or in a 10- x 10-foot grid will discourage most gulls and waterfowl from landing. Similar wire systems have been successfully used to keep gulls off roofs and out of landfills, and to exclude crows from electrical substations. When it is desirable to eliminate all bird use, netting can be installed over small ponds and similar areas. However, birds are sometimes tangled in the netting, and maintenance problems arise with high winds and freezing weather. Complete coverage of ponds with plastic, 3-inch diameter "bird balls" will completely exclude birds and yet allow evaporation of water. Designing ponds with steep slopes will discourage wading birds such as herons. Use of culverts to totally cover water in drainage ditches is recommended whenever possible.

9.2.b.iv.b. Exclusion of Mammals

Airports should have a "zero tolerance" policy for deer, livestock and other large mammals in the aircraft operating area because of their severe threat to aviation safety (see Table 7-1). The best, albeit most costly, procedure for excluding these animals is a permanent, 10-foot high chain-link fence with barbed-wire outriggers that is inspected regularly to fix any holes, wash-out areas or other breaches. This fence also serves as an excellent security barrier for the airport. There are also numerous electric-fence designs for excluding deer, discussed in Hygnstrom et al. (1994), that are not as costly as permanent fencing but have drawbacks in safety and maintenance.

This 5-strand electric fence is one of many designs that can be used to discourage deer and other large mammals from entering selected areas. (Photo by E. C. Cleary, FAA)

Cattle Guards are widely used to prevent hoofed livestock from traversing across fenced areas through permanent openings maintained for vehicular access. These devices, if at least 15 feet in length perpendicular to fence, will prevent deer from entering through gated areas on airports.

9.2.c. Repellent Techniques

Repellent and harassment techniques are designed to make the area or resource desired by wildlife unattractive, or to make the wildlife uncomfortable or fearful. Long term, the cost-effectiveness of repelling wildlife usually does not compare favorably with habitat modification or exclusion techniques. No matter how many times wildlife are driven from an area that attracts them, they or other individuals of their species will return as long as the attractant is accessible. However, habitat modifications and exclusion techniques will never completely rid an airport of problem wildlife; therefore, repellent techniques are a key component of any wildlife hazard management plan.

Gulls and other birds quickly habituate to electronically generated distress calls broadcast from stationary speakers. However, gull distress calls occasionally broadcast from speakers mounted on vehicles, used in combination with pyrotechnics and shooting, can be useful in dispersing gulls at airports. (Photo by R. A. Dolbeer, USDA)

Repellents work by affecting the animal's senses through chemical, auditory, or visual means. Habituation or acclimation of birds and mammals to most repellent techniques is a major problem. When used repeatedly without added reinforcement, wildlife soon learn that the repellent techniques are harmless. The repellents become a part of their "background noise", and they ignore them.

Critical factors to be recognized in deploying repellents are:

1. There are no "silver bullets" that will solve all problems;

2. Likewise, there is no standard protocol or set of procedures that is best for all situations. Repelling wildlife is an art as much as a science. The most important factor is having motivated, trained personnel with the appropriate equipment for their needs who understand the wildlife situation on their airport;

3. Each wildlife species is unique and will often respond differently to various repellent techniques. Even within a group of closely related species such as gulls, the various species will often respond differently to various repellent techniques;

4. Habituation to repellent techniques can be minimized by:

   a) using each technique sparingly and appropriately when the target wildlife is present,

   b) using a variety of repellent techniques in an integrated fashion,

   c) reinforcing repellents with occasional lethal control (with necessary permits in place) directed at abundant problem species such as gulls or geese.

Advances in electronics, remote sensing capabilities, and computers are resulting in the development of "intelligent" systems that can automatically deploy repellents (e.g., noisemakers, chemical sprays) when targeted wildlife enter a designated area. These devices may help reduce habituation and increase effectiveness of repellents in some situations. However, these devices will never replace the need for trained people on the

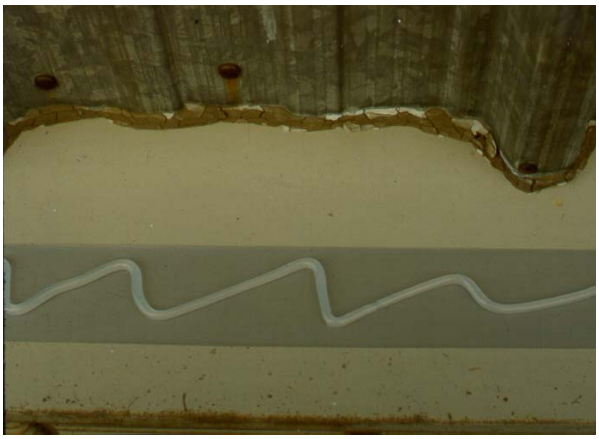
ground to respond appropriately to incursions by a variety of highly adaptable, sentient wildlife species.

9.2.c.i. Wildlife Patrols/Runway Sweeps in Vehicles

Regular patrols of airside areas to disperse birds and other hazardous wildlife are a critical component of an integrated program of wildlife hazard management at airports. Often, driving a vehicle towards the wildlife will be enough to cause the wildlife to disperse, especially if the driver has been deploying repellent and removal techniques as outlined below. Regular patrols and sweeps also permit Wildlife Control Personnel to learn the daily movement patterns, habitat preferences and behavior of wildlife on the airport. This information can be useful in determining wildlife attractants on the airport that need to be removed (e.g., low areas that gather standing water after rains) and in anticipating problem situations. All wildlife carcasses found during runway sweeps should be removed, identified to species and documented on a wildlife strike log for carcass remains (Table 8-2).

9.2.c.ii. Chemical Repellents for Birds

Chemical repellents, toxicants and capturing agents must be registered with the U.S. Environmental Protection Agency (USEPA) or Food and Drug Administration (FDA) before they can be used to manage wildlife at airports. Products must also be registered in each state. Hygnstrom et al. (1994) provide a listing of chemical products, by active ingredient and by company name, registered for birds and mammals. The following chemical repellents, listed by active ingredient, are presently available for use at airports.



Applying polybutene anti-perching material over duct tape, rather than directly to ledges or rafters, facilitates cleanup and re-application. (Photo by E. C. Cleary, FAA)

Perching structures (polybutenes). Several commercial products are available in liquid or paste form. These sticky formulations make birds uncomfortable when they alight on them, encouraging the birds to look elsewhere to perch or roost. To be effective, all perching surfaces in a problem area must be treated, or the birds will move a short distance to an untreated surface. Under normal conditions, the effective life of these materials is 6 months to 1 year. Dusty environments can substantially reduce the life expectancy. Once the material loses effectiveness, it is necessary to remove the old material and apply a fresh coat. Applying the material over duct tape, rather than directly to the building ledge or rafter surface, will facilitate clean up.

Turf feeding (methyl anthranilate, anthraquinone). There are 2 chemicals presently (1999) registered as bird repellents for turf. Methyl anthranilate is an artificial grape flavoring commonly used in foods and beverages. Birds have a taste aversion to methyl anthranilate, apparently reacting in much the same way that mammals react to concentrated ammonia (smelling salts). Methyl anthranilate is registered under commercial formulations as a feeding repellent for geese and other birds on turf (grass). The second repellent, anthraquinone, apparently acts as a conditioned-aversion repellent with birds. Birds ingesting food treated with anthraquinone become slightly ill, developing a post-ingestion aversion to the food. An anthraquinone formulation for repelling geese from turf also is available. Both products are liquid formulations applied by sprayer to the vegetation. Effectiveness of these sprays in repelling geese can be highly variable, depending on growing conditions, rainfall, mowing, and availability of alternate feeding areas. In general, effectiveness will be least (perhaps lasting only a few days) when grass is growing rapidly.

Water (methyl anthranilate). Methyl anthranilate formulations are also available for application to pools of standing water on airports and at other locations to repel birds from drinking and bathing. This application is probably best for temporary pools of water after rainfall, where repellency of only a few days is needed.

Fogging with a methyl anthranilate formulation may help disperse birds, such as tree swallows and killdeer, at airports. (Photo by J. T. Peterla, USDA)

General area (fogging with methyl anthranilate). A methyl anthranilate formulation is also available for use in fogging machines (thermal or mechanical) to disperse birds from hangars, lawns and other areas.

Frightening agent (Avitrol [4-Aminopyridine]). Avitrol is registered for repelling pigeons, house sparrows, blackbirds, grackles, cowbirds, starlings, crows, and gulls from feeding, nesting, loafing, and roosting sites. Birds eating Avitrol-treated baits react with distress symptoms and calls, behaviors that frighten away other birds in the flock. Avitrol, although registered as a “frightening agent”, is lethal to the birds that eat treated baits. Therefore, Avitrol should be treated as a toxicant. Avitrol-treated bait is diluted with untreated bait so that most birds in the flock do not ingest treated bait. The primary use of Avitrol at airports has been in pigeon control around buildings. The use of Avitrol requires knowledge of the feeding patterns of the birds, proper prebaiting procedures to ensure bait acceptance and avoidance of nontarget species, and removal of dead birds after treatment.

9.2.c.iii. Chemical Repellents for Mammals

There are a number of taste and odor repellents marketed to repel deer, rabbits and other mammals from browsing on vegetation (Hygnstrom et al. 1994). These include products that are applied directly to the vegetation and general area (odor) repellents (e.g., predator urine). Some of these products may be appropriate for short-term protection of valuable landscaping plants and fruit trees. However, their use at airports to repel or discourage deer or other mammals is not recommended because they are unlikely to have any influence on wildlife movements in the airport operating area. For example, a recent study showed that predator urines (coyote, bobcat) had no influence on deer movements along established trails or at feeding sites.

9.2.c.iv. Audio Repellents for Birds

Propane cannons can be used as part of an integrated program to disperse birds from airports. However, birds quickly habituate to the loud bangs if the cannons are used continuously and not integrated with other frightening devices. (Photo by G. E. Bernhardt, USDA)

Propane cannons. Propane cannons (exploders) generate a shotgun-sounding blast. In general, birds quickly habituate to cannons that detonate at systematic or random intervals throughout the day. Thus, to be effective cannons should be moved periodically, used sparingly, and then only when birds are in the area. Reinforcement by occasional killing of a few birds (of common species such as gulls and starlings under an appropriate permit) with a shotgun may also enhance effectiveness. Systems designed so that cannons placed around an airport can be detonated remotely on demand by radio signal when birds are in the area are a useful feature to reduce habituation.

Distress-call and electronic noise-generating systems. Recorded distress calls are available for common birds at airports such as gulls, crows, and starlings. Such calls, broadcast from speakers mounted on a vehicle, will often initially draw the birds toward the sound source to investigate the threat. The birds then can be dispersed by shell crackers or other pyrotechnics or by using a shotgun to shoot an occasional bird. As with propane cannons, distress calls routinely broadcast from stationary speakers, with no associated follow-up stimuli that provide additional fear or stress, have little utility. Birds also habituate rapidly to other electronic sound systems that generate a variety of sounds from a stationary speaker.

Shell crackers and other pyrotechnics. There are a variety of projectiles that can be fired from breech-loaded shotguns or from specialized guns to provide an auditory blast or scream, as well as smoke and flashing light, to frighten birds. Some of the newer cartridges have ranges of up to 300 yards. These pyrotechnics, when used skillfully in

combination with other harassment techniques and limited lethal control (shooting via shotgun), can be very useful in driving birds off an airport. An advantage of these pyrotechnic devices is that they require a person to fire the projectile, thus ensuring that they are deployed directly at the target birds and that the birds associate the pyrotechnic with a threat (person).

Ultrasonic sound devices. Ultrasonic (i.e., above the sound range detected by humans) sound devices have not proven to be effective bird repellents. In fact, most birds do not detect frequencies as high as humans can detect, much less frequencies above the level of human detection. During tests conducted by the U.S. Department of Agriculture's National Wildlife Research Center, pigeons showed no response when exposed within 10 feet to a fully functional, high-frequency sound generating device. Such devices should not be deployed in hangars or other airport settings to deter birds.

9.2.c.v. Audio Repellents for Mammals

Probably the most commonly used audio scaring device for deer is the propane cannon. However, deer rapidly habituate to propane cannons. Their use at airports to repel deer and other mammals from runways is not recommended except for very short-term (i.e., several days), emergency situations until a more permanent solution (fencing or deer removal) can be achieved. Other electronic noise-generating devices also have proven ineffective in repelling deer or other mammals for more than a few days. Pyrotechnics also provide only short-term repellency for mammals.

In one test conducted by USDA, large eye-flags were exposed to pigeons in an abandoned building. As soon as the flags were put up the birds left the building, but within 24 hours they returned. From then on the birds behaved in a normal fashion and showed no reaction to the flags. (Photo by R. A. Dolbeer, USDA)

9.2.c.vi. Visual Repellents for Birds

Most visual repellents are simply a variation on an ancient theme -- the scarecrow. In general, visual repellents such as hawk effigies or silhouettes, eye-spot balloons, flags, and Mylar reflecting tapes have shown only short-term effectiveness and are inappropriate for use as a long-term solution to bird problems at airports. Most short-term success achieved with these devices is likely attributable to "new object reaction" rather than to any actual frightening effect produced by them.

There has been interest in recent years in the use of laser rifles (laser beams dispensed from a laser source attached to a rifle stock with a rifle scope as a "gun sight") to disperse birds at airports and other sites. The laser beam is aimed at individual birds or flocks of birds. Effectiveness apparently

is diminished in sunlit conditions. More experimental work is needed on this technique. The use of lasers in an airport environment obviously requires extreme caution.

9.2.c.vii. Visual Repellents for Mammals

For the most part, visual repellents such as flags and effigies have proven ineffective for repelling mammals. Their use is not recommended for keeping deer or other mammals off airports.

9.2.c.viii. Trained Falcons and Dogs to Repel Birds

Trained falcons and other birds of prey have been used intermittently on various airports in Europe and North America to disperse birds since the late 1940s. The advantage of falconry is that the birds on the airport are exposed to a natural predator for which they have an innate fear. The disadvantage is that a falconry program is often expensive, requiring a number of birds that must be maintained and cared for by a crew of trained, highly motivated personnel. Furthermore, the effectiveness of falconry programs in actually reducing strikes has been difficult to evaluate.

The successful use of border collies to repel birds requires a high degree of dedication and commitment by the handler. (Photo by B. U. Constantin, USDA)

Blokpoel (1976) outlined the following summary of falconry for airports that is still a good overall assessment : 1) properly trained birds of prey of the right species for the job at hand, used regularly and persistently by skilled and conscientious personnel, are effective in clearing birds from airfields during daylight and good weather; 2) for good results, daily operations on a year-round basis are required in most cases; 3) several falcons are required to have at least 1 bird ready at all times; and 4) to obtain, train, operate and care for falcons, a staff of at least 2 full-time, well-trained personnel is required.

The use of trained dogs, especially border collies, to chase geese and other birds from golf courses, airports and other sites, is a recent development. As with falcons, the advantage is exposure to a natural predator. Likewise, the disadvantage is that the dog must be under the control of a trained person at all times, and the dog must be cared for and exercised 365 days a year. A dog will have little influence on birds that are flying over the airport.

9.2.c.ix. Radio-controlled Model Aircraft to Repel Birds

Radio-controlled (RC) model aircraft, which provide both visual and auditory stimuli, occasionally have been used to harass birds at airports. One advantage is that the RC aircraft is under the control of a person and can be directed precisely to herd the birds away from the airport runway. A second advantage is that the RC aircraft can be deployed on an "as needed" basis with little maintenance needed between flights. Some RC aircraft have been designed to mimic the appearance of a falcon and even to remotely fire pyrotechnics. The disadvantage is that a trained person is required to operate the RC aircraft in an airport environment. Operators of RC aircraft should insure that the radio frequencies being used are compatible with other radio uses in the airport environment.

9.2.d. Wildlife Removal Techniques

Habitat modification, exclusion, and repellent techniques are the first lines of action in any Wildlife Hazard Management Plan. However, these actions will not solve every problem; therefore, hazardous wildlife sometimes must be removed from an airport. Such removal can be accomplished by capturing and relocation or by killing the target animals. With few exceptions, a federal Migratory Bird Depredation Permit, and in many cases a state permit, is required before any migratory birds may be taken (captured or killed). A state permit is generally necessary before any state-protected birds or mammals may be taken. Any capturing or killing must be done humanely and only by people who are trained in wildlife species identification and the techniques to be deployed.

9.2.d.i. Capturing Birds and Mammals

The disposition of live-captured birds and mammals will depend on the legal, political, and social realities of each situation. State wildlife agencies are increasingly restrictive regarding the relocation of captured wild animals, particularly for common species, because of disease concerns and the creation of additional wildlife problems at release sites. When practical, unprotected birds such as pigeons, house sparrows and European starlings, should be euthanized using procedures recommended by the American Association of Wildlife Veterinarians (AAWV). Common mammals such as raccoons, woodchucks, and coyotes captured at airports generally also should be euthanized, following state regulations. Resident Canada geese captured during molt or by nets can be euthanized and donated to soup kitchens or food banks, provided the necessary federal and state permits are in place.

9.2.d.i.a. Chemical Capture of Birds

Alpha Chloralose (A-C) is registered with the FDA as an immobilizing agent for use in capturing waterfowl, coots, and pigeons. A-C can only be used by people certified to use A-C working under authority of personnel with the U.S. Department of Agriculture, Wildlife Services (USDA/WS). A-C, incorporated into bread baits, is ideal for selectively capturing ducks, geese and coots that can be hand-fed at urban ponds and parks. Corn

baits are recommended for pigeons or groups of waterfowl or coots that cannot be individually baited. Birds ingesting a clinical dose of A-C can be captured in 30 to 90 minutes. Complete recovery normally occurs within 8 hours but can take up to 24 hours.

Alpha Chloralose (A-C) is ideal for capturing waterfowl that can be individually fed. Here, USDA personnel are using A-C treated bread baits to capture mute swans at a pond in Ohio, December 1994. (Photo by E. C. Cleary, FAA)

9.2.d.i.b. Live-trapping Birds

The major advantage of live trapping is selectivity: any nontarget birds can be released unharmed. The major disadvantage is that live trapping is often labor intensive. Traps must be tended frequently to remove captured animals and, in the case of cage traps with decoy birds, to provide food and water. Hygnstrom et al. (1994) provide detailed descriptions of various trap designs.

Trapping is used on some airports to remove raptors (hawks and owls) in the aircraft operating area. Bal-chatri, noose carpets, Swedish goshawk, or sliding padded pole traps are typically used. Because raptors are desirable components of bird communities, most permits for trapping raptors require that the birds be banded and relocated into suitable habitat at least 50 miles from the airport.

Safety, for both the personnel involved and the wildlife, must be a prime consideration when using a rocket net to capture gulls or other birds. (Photo by P. P. Woronecki, USDA)

Live trapping, using walk-in type traps on roofs or other isolated sites, can be used to remove pigeons at airports. Captured pigeons should be euthanized. If relocated, pigeons can fly long distances to return to the site of capture.

Cannon or rocket nets are well suited for capturing up to 100 or more nuisance waterfowl, pigeons or gulls in situations where other methods may not be practical. The net must be placed where it can be safely discharged, and the target birds must be trained to feed in front of it. Depending on the situation, prebaiting can take from 1 to several days.

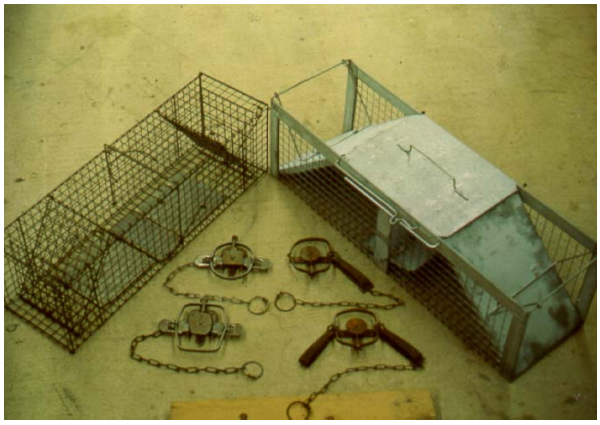
Net launchers use a single large rifle blank cartridge to propel a net. Fired from the shoulder much like a shotgun or rifle, net launchers can capture individual or small groups of problem birds that can be approached within about 50 feet.

9.2.d.i.c. Chemical Capture of Mammals

Large mammals such as deer can be captured with tranquilizer guns, but this is generally not a practical or desirable option for airports. Live capture and relocation of deer is not recommended or permitted in most states because deer populations are at or near carrying capacity. However, in those situations where the use of firearms is not safe or practical, the use of tranquilizer guns may be appropriate. The use of tranquilizer guns requires trained personnel with a high degree of skill and experience. If used in an airport environment, safeguards must be in place to insure partially tranquilized deer do not enter runway areas.

9.2.d.i.d. Live-trapping Mammals

Specialized drop-door traps, drop nets, or rocket net set-ups can be used to live-capture deer, but live-capturing deer generally is not recommended for airport situations for reasons outlined above. However, smaller box-type or basket live-traps can be used to capture medium-sized mammals such as raccoons, woodchucks, beavers and feral dogs. Leg-hold traps and foot snares can be used to capture coyotes, feral dogs and raccoons.



A variety of traps are available for use in capturing small to medium-sized mammals. Their successful use requires a high degree of skill, perseverance, and experience. (Photo by E. C. Cleary, FAA)

Successful mammal trapping, especially with leg-hold traps and snares, requires a high degree of skill and experience. Once set, traps must be checked frequently (at least once every 24 hours and more frequently in hot or cold weather). Trappers must be knowledgeable in procedures for handling and euthanizing mammals. State and local regulations may restrict the use of some types of traps.

9.2.d.ii. Killing Birds and Mammals

In general, killing of wildlife on an airport is the last option deployed after habitat modification, exclusion techniques, and repellent actions have been implemented. However, the management of a wildlife hazard situation on an airport may require killing a particular animal, or require that a local population of a problem species be reduced by lethal means until a long-term, nonlethal solution is implemented (e.g., erection of deer-proof fence, relocation of nearby gull nesting colony). In addition, lethal control of

a few individuals is sometimes necessary to reinforce nonlethal frightening techniques. At least some lethal control is usually necessary as part of an integrated Wildlife Hazard Management Plan for an airport.

In order to justify lethal control and to minimize adverse public reaction to a program involving killing, the following information should be developed:

1. Documentation that the wildlife species is an economic, safety or health threat on the airport;

2. Justification of why nonlethal options are not adequate to solve the problem;

3. An assessment of the impact that the killing will have on local and regional populations of the species (i.e., is the level of killing planned likely to result in a significant reduction in numbers of the species at the local or regional level?);

4. Documentation of the effectiveness of the killing program in helping to solve the problem (e.g., reduction in strikes);

5. Recommended steps to be taken, if any are feasible, to reduce the need for killing in the future.

9.2.d.ii.a. Destroying Eggs and Nests

Canada geese, mute swans and gulls should not be allowed to nest on airport property. Provided the correct permits are in place, any goose, mute swan or gull nests with eggs found on an airport should be destroyed (eggs broken and nest material removed). Egg addling (oiling, shaking or puncturing), whereby the birds continue to incubate nonviable eggs, is not recommended for airports. Egg addling encourages the nesting birds (and any nonbreeding birds associated with them) to stay on the airport. At the time of nest destruction, the adult birds should be harassed from the airport, and the nesting area should be checked weekly for renesting until the end of the nesting season (generally the end of June). As an alternative to harassment, it may be better to shoot nesting geese and mute swans (see below).

Canada geese should not be allowed to nest on airport property. Nests and eggs should be destroyed after appropriate permits are obtained. (Photo by J. L. Bucknall, USDA)

Nests of pigeons, starlings, and house sparrows at airports should be destroyed whenever they are encountered in buildings and structures. Physical barriers, as discussed above, should then be installed where practical to prevent renesting.

Nests of other birds hazardous to aviation generally also should be destroyed when encountered at airports. However, each situation will have to be addressed on a case by case basis, depending on the species of bird and level of threat posed, location from runways, bird movement patterns and other factors.

9.2.d.ii.b. Shooting Birds

The occasional use of a shotgun to kill gulls and other common birds, after permits have been obtained, is sometimes necessary to enhance other frightening methods, such as propane cannons. (Photo by R. A. Dolbeer, USDA)

Shooting birds in an airport environment generally falls into 2 categories. First, pigeons using hangars, bridge girders and other sites can be shot at night with an air rifle. This night-time shooting is done quietly and discretely, with the objective being to disturb the birds as little as possible so that the maximum number can be removed.

In the second category of shooting, common birds such as gulls and geese in the aircraft movement area that are not responding to various repellent methods can be shot with a 12-gauge shotgun. This shooting is done during daylight in the open so that other birds can witness the action. Shooting a shotgun has several effects on a flock of birds. First, shooting reinforces other audio or visual repelling techniques. Second, the loud noise, coupled with the death of one or more of the flock members, can frighten the rest of the flock away. Third, the target birds are removed.

Four cardinal rules apply when using shooting as a control method at airports:

1. Use only personnel who are trained in the use of firearms and who have an excellent knowledge of wildlife identification;
2. Use the proper gun and ammunition for the situation;
3. Have necessary federal and state wildlife kill permits in place and keep good records of birds killed by species and date;
4. Notify airport security, air traffic control and, if appropriate, the local law enforcement authority, before instituting a shooting program. Local ordinances against the discharge of firearms within certain distances of buildings, or within the city limits may have to be waived.

9.2.c.ii.c. Shooting Mammals

There should be a "zero tolerance" for deer at airports. If fencing is inadequate to keep deer off an airport or if deer have gotten inside the airport fence, shooting is the best procedure for removing the deer. Shooting on airports should be done by professional sharpshooters, using non-ricocheting bullets in rifles equipped with night-vision scopes and noise suppressers, to ensure safe and efficient removal. Elevated shooting stands can be erected on the ground or on a truck bed to direct shots toward the ground. Meat from deer that are removed from airports in this manner should be donated to charity. Shooting of deer at airports must be coordinated through the state wildlife agency.

Hunting during the regular deer season should be encouraged in areas adjacent to airports having deer problems to reduce the population in the general area. Archery hunting sometimes can be used in areas closed to firearm use. (Photo by *E.* C. Cleary, FAA)

9.2.d.ii.d. Oral Toxicants for Birds

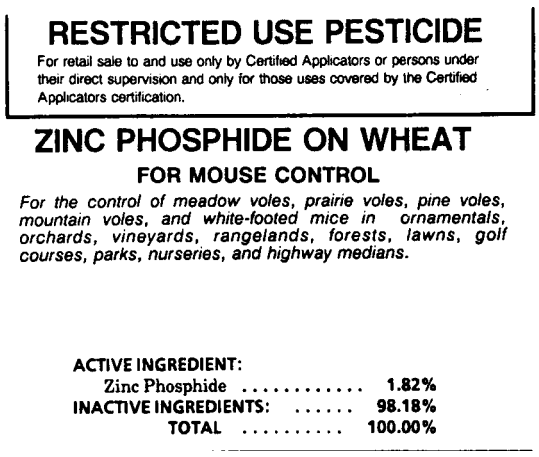
Currently in the United States, only 1 oral toxicant, DRC-1339 or Starlicide (active ingredient 3-chloro-p-toluidine hydrochloride) is registered with the USEPA for use in bird population management. Starlicide (0.1% active ingredient) is formulated in a pelleted bait for use at feedlots to control starlings and blackbirds. DRC-1339 (98% active ingredient) can be formulated with a variety of baits and used to control starlings, pigeons, gulls, ravens and blackbirds under certain conditions, some of which may be applicable at airports. The control of pigeons around airport buildings and starlings roosting on or near an airport are the situations most likely applicable. Only USDA/WS personnel or persons working under their direct supervision can use DRC-1339.

The use of toxic baits to kill target birds without affecting nontarget species requires considerable skill and patience. Daily movement patterns of the target birds among feeding, loafing, and roosting sites must be determined so that attractive bait sites that are controlled from public access (such as a roof top) can be selected. The proper bait (a highly desired food) must be selected, and the birds then must be prebaited, often for a week or more, to ensure good bait acceptance and that nontarget animals are not visiting the bait site. Proper prebaiting is the most critical step of a successful program. During the baiting period, all uneaten bait must be removed daily. With DRC-1339, birds typically die 1-3 days after bait ingestion; therefore, areas surrounding bait sites will need to be searched for several days after baiting to remove dead birds.

9.2.d.ii.e. Contact Toxicants for Birds

Hollow metal perches, containing a wick treated with the toxicant, fenthion, have been used to control pigeons, house sparrows and starlings in and around buildings. Presently, the USEPA is phasing out the use of fenthion-treated perches because of concerns for secondary poisoning of raptors and mammalian scavengers feeding on dying birds. No replacement chemical has been registered at this time (1999).

If toxic perches become available, their use outside of buildings is not recommended because there are no means of preventing nontarget birds from landing on these perches. Even when used inside buildings, careful placement of perches and monitoring must be done to ensure nontarget birds such as swallows are not exposed to the toxicant. All dead birds should be picked up and properly disposed.



RESTRICTED USE PESTICIDE

For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicators certification.

ZINC PHOSPHIDE ON WHEAT

FOR MOUSE CONTROL

For the control of meadow voles, prairie voles, pine voles, mountain voles, and white-footed mice in ornamentals, orchards, vineyards, rangelands, forests, lawns, golf courses, parks, nurseries, and highway medians.

ACTIVE INGREDIENT:	
Zinc Phosphide	1.82%
INACTIVE INGREDIENTS:	98.18%
TOTAL	100.00%

This is the center portion of a zinc phosphide rodenticide label showing the restricted use statement, target species, and ingredients list. Other parts of the label that provide information about the product such as the manufacturer, EPA registration number, and the directions for use, are not shown here. Always read the entire label before using any pesticide.

9.2.c.ii.f. Toxicants for Mammals

Small rodent populations (e.g., voles, house and deer mice, Norway rats) may erupt in grassy and brushy areas or around construction debris at airports, attracting raptors and creating a hazard to aviation. In general, populations of these rodents should be controlled by habitat management (mowing, sanitation, clean-up). However, there may be situations where the use of a rodenticide is appropriate to reduce rodent populations in airside vegetation. The control of commensal rodents in airport terminal buildings and other facilities will not be discussed here because these jobs are usually handled by private pest control operators.

There are 2 types of rodenticides that may be available for use in airside vegetation, anticoagulants and acute toxicants. Anticoagulants, of which there are several types registered, cause the rodent to die from internal bleeding. Some anticoagulants require multiple feedings to induce sufficient bleeding for death whereas others require only a single feeding. The only acute toxicant registered for above-ground treatment of field rodents is zinc phosphide, available in pelleted and grain-bait formulations and as a concentrate for specialized bait formulations.

Depending on registration label instructions, rodenticide baits can be broadcast in the vegetation or hand-placed in burrows and runways. Anticoagulant baits can also be placed in various types of bait containers placed in areas of high rodent activity. Care

must be taken to minimize nontarget bird and mammal exposure with broadcast and hand-placed baits.

9.2.c.ii.g. Fumigants for Mammals

Several brands of gas cartridge are available to control burrowing rodents, such as woodchucks. (Photo by E. C. Cleary, FAA)

Burrowing rodents at airports, such as woodchucks (ground hogs) and prairie dogs, can be killed by fumigation of burrows with either gas cartridges or aluminum phosphide tablets. Gas cartridges, ignited from a burning fuse after placement in the burrow, generate carbon monoxide. Aluminum phosphide pellets react with moisture in the burrow to produce phosphine gas. Care must be taken to plug all burrow entrances with sod after placement of the cartridge or pellets in the burrow. Gas cartridges are a general use, over-the-counter pesticide. Aluminum phosphide pellets can only be applied by certified pesticide applicators and may not be available in all states. As with all pesticides, it is critical to make sure the wildlife species you are treating is covered under the registration for your state.

9.2.c.ii.h. Lethal Traps for Mammals

Depending on state and local laws, Conibear^{R} (body gripping) traps can be used to remove woodchucks, beaver, and other medium-sized mammals that create problems at airports. Neck snares can be used to capture coyotes, beaver and certain other mammals. The use of these lethal traps requires a high degree of skill and experience. Once set, traps must be checked frequently (at least once every 24 hours and more frequently in hot or cold weather) to euthanize any animals that may be captured but not killed. Trappers must be knowledgeable in procedures for handling and euthanizing captured mammals.

9.3. CONCLUSIONS

Habitat modifications to minimize food, cover and water and physical barriers to exclude wildlife are the foundations of wildlife hazard management programs for airports. In addition, an integrated array of repellent techniques is necessary to disrupt normal behavior and to stress hazardous wildlife that attempt to use the airport. These repellent techniques must be used judiciously and backed by real threats to minimize habituation. To this end, lethal control of selected individuals of common species is sometimes necessary to reinforce repellent actions. Furthermore, the management of a wildlife hazard situation on an airport may require removal of a particular animal or group of animals, or require that a local population of a problem species be reduced by lethal means until a long-term, nonlethal solution is implemented. Finally, the most

critical factor for the success of a wildlife hazard management program is to have motivated and trained professionals who are knowledgeable about the wildlife species attempting to use the airport environment and the techniques used to manage the problems these species create.

Birds and aircraft will always share the skies, and there will always be the risk of collisions. To minimize that risk, airports must be managed to be as unattractive to birds as possible. Integrating various control strategies offers the maximum long-term effectiveness, immediate relief from a hazardous situation and minimizes the need for the use of lethal control methods. (Photo courtesy USDA)

9.4. OTHER SOURCES OF INFORMATION

For details on techniques, equipment, chemical registrations, species-specific management recommendations and sources of supply, the reader is referred to:
Hygnstrom, S. C., R. M. Timm, and G. E. Larson, *editors.* 1994. *Prevention and control of wildlife damage*. University of Nebraska Cooperative Extension Division, Lincoln, Nebraska. (This 2-volume manual is also available online at: ianrwww.unl.edu/wildlife/solutions/handbook/)

In addition, Appendix K provides a list of research publications by the U.S. Department of Agriculture, National Wildlife Research Center (NWRC) documenting results of evaluations of various wildlife control products and strategies. These evaluations were conducted between 1992-1999 with support from the FAA under an interagency

agreement with NWRC. This is not a complete list of all evaluations that have been done on all wildlife control methods, but it does provide information on many of the control methods discussed in this chapter.

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